## MATH 353: Engineering Mathematics III – Section 012

> Every time you finish an exercise, write down the result and check with me.

1. We are given five points:

$$(0,1), \quad (1, \tfrac{3}{2}), \quad (2,0), \quad (\tfrac{5}{2}, -1), \quad (3,3).$$

(a) Evaluate the interpolation polynomial at the point $x_0 = 0.4$.

(b) Compute the Newton divided differences (use `divideddiff` for this)

(c) Write down the formula for the interpolation polynomial in Newton's form.

2. Make a plot of the same five points given above. Use circular markers. On top of them, plot the spline that interpolates them. (The result of this exercise is: the list of instructions you used and a check mark written by me on this space.)

   What is the value of the interpolation spline at the points 0.4 and 0.7?

3. Following what we have done today. You have a sequence of errors $E_h$ depending on a parameter $h$. They are shown in the following table ($h$ on the left column, $E_h$ on the right):

```
>> [h' err']
ans =
   0.500000000000000   0.250000000000000
   0.250000000000000   0.062500000000000
   0.125000000000000   0.015625000000000
   0.062500000000000   0.003906250000000
   0.031250000000000   0.000976562500000
   0.015625000000000   0.000244140625000
   0.007812500000000   0.000061035156250
   0.003906250000000   0.000015258789063
   0.001953125000000   0.000003814697266
   0.000976562500000   0.000000953674316
```

We claim that $E_h \approx Ch^p$ for some $p$ to be determined.

(a) Justify the formula
$$\log\left(\frac{E_{h_1}}{E_{h_2}}\right) \approx p \log\left(\frac{h_1}{h_2}\right)$$

(b) Use it to figure out what $p$ is.

(c) Make a loglog plot of $(h, E_h)$. (You need to get a check from me here.) What is the slope of the line you obtain?

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